Notes on the Ecology of the Pogonophoran Genus *Galathealinum* Kirkegaard, 1956

Oluwafeyisola S. Adegoke[1]

The pogonophoran genus *Galathealinum* Kirkegaard, 1956 has a rather wide areal and latitudinal range in the northern hemisphere. It has been recorded from the Arctic Ocean, latitude 69° 32′N (Southward, 1962) to the Celebes Sea, about 1° 50′ north of the Equator (Kirkegaard, 1956). This wide latitudinal range makes the genus an exceptionally good one for examining the ecological factors which control pogonophoran distribution, and one would like to know what ecologic factors may be found to interpret the wide latitudinal range.

Four species have been described within the genus. The first, *Galathealinum bruuni* (the type species) was described by Kirkegaard (1956) from the Celebes Sea in the western Pacific. Ivanov (1961) next described *G. brachiosum* from the Pacific coasts of Canada and Oregon. The most northerly known species, *G. arcticum* was described by Southward (1962) from Thetis Bay, Herschell Island, north of Yukon, Alaska. The writer recently (Adegoke, 1967) described the fourth species, *G. mexicanum* from collections made in the Gulf of Tehuantepec, Mexico. The specimens from the same region earlier listed as *G. bruuni*(?) by Parker (1963:86) belong to this latter species. Apart from these four species, Hartman and Barnard (1960) listed the occurrences of a few large-sized fragments (3–4 mm diameter) of pogonophoran tubes from West Cortes, East Cortes, and Long basins, and from the San Diego Trough off the coast of southern California. These fragments were later referred to the genus *Galathealinum* by Hartman (1961:546). Although specifically indeterminable, these fragments are significant because they are the largest reported tubes of members of this genus.

[1] Division of Geological Sciences, California Institute of Technology, Pasadena, California. Present address: Department of Geology, University of Ife, Ibadan Branch, Ibadan, Nigeria, West Africa. Manuscript received September 29, 1966.

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ECOLOGY

Because the first records of pogonophoran species were from great depths it was initially assumed that pogonophorans were exclusively inhabitants of abyssal and hadal depths (Kirkegaard, 1956:80). Subsequent records (Ivanov, 1963; Jägersten, 1956; Kirkegaard, 1958; A. J. Southward, 1958; E. C. Southward, 1962; Southward and Southward, 1958, 1963) of pogonophoran species from extremely shallow waters (for example, *Siboglinum caulleryi* Ivanov from 22 m in the Sea of Okhotsk; and *Galathealinum arcticum* Southward from 36 m in Thetis Bay, Herschell Island, Yukon, Alaska) clearly showed that absolute depth is not necessarily a limiting factor in pogonophoran ecology. It is now known that, although a majority of pogonophoran species inhabit abyssal and hadal depths, only a few are characteristically confined to such habitats (Ivanov, 1963:123–126; Southward, 1962:385). Many species are encountered at comparatively shallow depths and a few forms are also known to dwell at bathyal or even sub-littoral depths. A relatively large number, however, thrive in shallow as well as in deep waters. Thus, *S. caulleryi* Ivanov has been recorded from depths ranging from 22 m in the Sakhalin Gulf to depths of about 8,164 m in the Kuril-Kamchatka Trench (Ivanov, 1963:221). According to D. B. Carlisle (see Ivanov, 1963:123), this is the greatest known bathymetric range for any known species of marine organism.

In the light of these presently known depth distributions, Kirkegaard (1958:1087) and

Southward (1962) concluded that the limiting factor in pogonophoran distribution is low water temperature rather than absolute depth. The geographic, latitudinal, and bathymetric distribution of the recorded species of *Galathealinum* discussed below corroborates the views of Kirkegaard and Southward.

The geographic and bathymetric distribution of the four species of *Galathealinum* and of the undetermined species from southern California (Hartman and Barnard, 1960; Hartman, 1961) are shown in Table 1. Figure 1 shows a plot of the minimum depth of occurrence of the species against latitude of occurrence. The data show that there is a direct correlation between these two parameters. The species occupy increasingly greater depths the lower the latitude.

The approximate values of bottom temperatures at the localities where the pogonophoran species discussed here were collected are shown also in Table 1. Temperature values were obtained from published sources, especially from the work of Emery (1954, 1960), Emery and Rittenberg (1952), Kramp (1957), Marmer

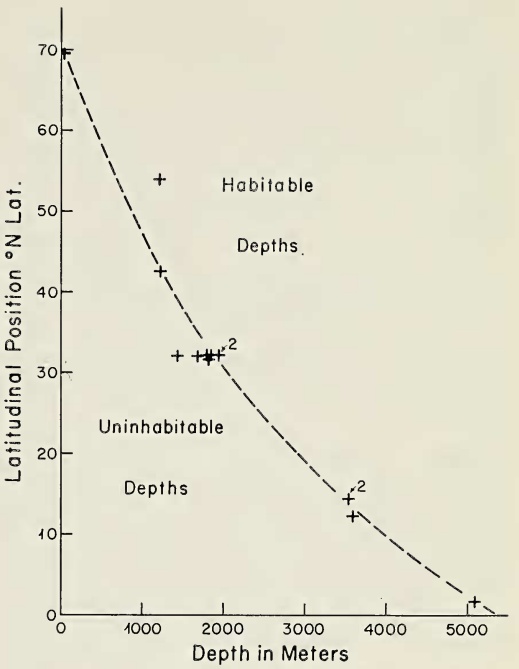

FIG. 1. Relationship between latitudinal position and minimum depth range of species of *Galathealinum*.

TABLE 1

GEOGRAPHIC AND BATHYMETRIC DISTRIBUTION OF SPECIES OF *Galathealinum* KIRKEGAARD, 1956

SPECIES	LOCATION	LATITUDE	LONGITUDE	DEPTH IN METERS	BOTTOM TEMP. °C
Galathealinum arcticum	Thetis Bay, Herschell Island, Yukon, Alaska	69°32′N	138°57′W	36	ca. 0°
Galathealinum brachiosum	west coast of Canada west coast of Oregon	54°23′N 42°40′N	134°41′W 124°29′W	1233–2605	0.61°– 0.72°
Galathealinum sp. indet.	East Cortes Basin, southern California	32°21′N 32°16′30″N	118°40′10″W 118°27′55″W	1872 1801	3.13°
	West Cortes Basin, southern California	32°21′N 32°14′N 32°11′N	119°14′W 119°15′W 119°18′W	1924 1923 1668	3.3°
	San Diego Trough	32°19′N	117°26′55″W	1420	—
	Long Basin, southern California	31°55′09″N	119°10′W	1833	2.70°
Galathealinum mexicanum	Gulf of Tehuantepec, Mexico	14°28′N 12°20′N	95°09′W 91°51′W	3529–3557 3596–3642	1.5° 1.5°
Galathealinum bruuni	Celebes Sea	1°50′N	119°30′E	5090–5110	3.8°

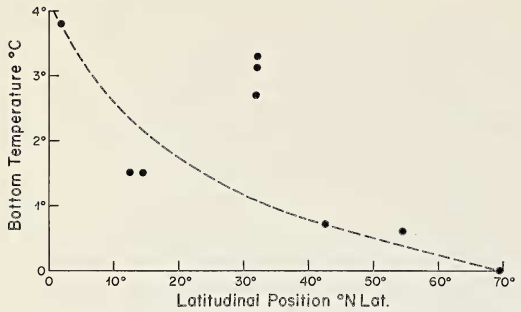

FIG. 2. Relationship between bottom temperatures (°C) and the latitudinal position of species of *Galathealinum*.

(1930), Parker (1963), Sverdrup et al. (1942), and from the Oceanographic Atlas of the Polar Seas, Part II (U. S. Navy Hydrographic Office, 1957). The distribution of bottom temperatures in relation to the latitudinal position of the pogonophoran species is shown in Figure 2. The graph shows that the species closest to the Equator live in comparatively warmer water than those from more northern latitudes. The total temperature range for all the four species, however, is less than 4°C. This narrow range in temperatures, and the fact that these temperatures are from 0°– 4°C, seem to explain why these species occupy continuously deeper waters from high to low latitudes. At high latitudes, the temperatures of the water from near the surface to great depths are similar and are within the range of value known at present for species in this genus. Hence, one could expect that species at high latitudes may occupy the total depth range of the genus provided that other ecological conditions, such as adequate food supplies (as indicated by Kirkegaard, 1956; 1956*a*), are satisfied.

The occurrence of the undetermined species from southern California at relatively shallower depths than expected (Fig. 1) and in relatively warmer water (Fig. 2) than expected is notable. These basinal occurrences are rather anomalous. More data are needed to explain satisfactorily this particular case.

The diameter of the tubes and the thickness of coarse (external) fibers of the tube walls for the species of *Galathealinum* were examined and found to differ widely. The data are shown in Table 2. The tube diameter and coarse fiber thickness do not show a direct relationship to latitude. Their values increase from the Equator northward, reaching maximum dimensions between 31°55′N and 32°21′ N, and decreasing from there toward high latitudes. It is interesting to note that the largest species and the one with the coarsest fibers occur at mid-latitudes (about 31°– 32°N) and not at high or low latitudes. But whether this is related to any ecological factors cannot be determined with the data at hand.

Additional data are needed on species distribution, temperature, and nature of bottom conditions to determine whether the indicated relationships are real or merely fortuitous.

TABLE 2

RELATIONSHIP OF TUBE DIAMETER AND COARSE FIBER THICKNESS TO LATITUDINAL POSITION OF SPECIES OF *Galathealinum* KIRKEGAARD, 1956

SPECIES	LATITUDE	DIAMETER OF TUBE (MM)	THICKNESS OF COARSE FIBERS (μ)
Galathealinum arcticum	69°32′N	1.33–1.95	1–2
Galathealinum brachiosum	54°23′N to 42°40′N	2.0–2.6	7–12
Galathealinum sp. indet.	32°21′N to 31°55′09″N	3.0–4.0	—
Galathealinum mexicanum	14°28′N to 12°20′N	1.96–2.5	15–22
Galathealinum bruuni	1°50′N	0.8–2.0	2–4

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